Indentation-induced dislocations and cracks in (0001) GaN bulk crystals

I. Ratschinski, H.S. Leipner, W. Fränzel, G. Leibiger, F. Habel, W. Mook and J. Michler

1. Interdisziplinäres Zentrum für Materialwissenschaften, Martin-Luther-Universität Halle-Wittenberg, D-06099 Halle, Germany
2. FG Photovoltaik, Institut für Physik, Martin-Luther-Universität Halle-Wittenberg, D-06099 Halle, Germany
3. Freiberger Compound Materials GmbH, D-09599 Freiberg, Germany
4. Laboratory for Mechanics of Materials and Nanostructures, EMPA Material Science & Technology, CH-3602 Thun, Switzerland

hartmut.leipner@cmat.uni-halle
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The (0001) surface of GaN bulk crystals with a density of in-grown dislocations in the magnitude of \(10^6\) cm\(^{-2}\) and a thickness of several millimeters has been indented with a cube corner indenter at room temperature. The measurements were performed with a microindenter in a scanning electron microscope (SEM) and a nanoindenter using different indenter orientations in relation to the crystals. Dislocations and cracks at the indentations were investigated by means of optical microscopy (OM) and scanning electron microscopy in secondary electron contrast (SE) and cathodoluminescence (CL) (Figure 1).

Dislocations occur at all indentations for the loads applied. The arrangement of indentation-induced dislocations corresponds to the symmetry of the indented surface. Higher loads induce lateral cracks beneath the surface and a distinct pile-up at the indentations. In addition, GaN crystals were deformed by a Vickers indenter and the arrangement of dislocations and cracks is described [1]. Finally, the results obtained by the different types of indenters are compared.


![Figure 1](image-url)

Figure 1. Investigation of indentations in the (0001) surface of a GaN bulk crystal: (a) In-situ indentation in a SEM, (b) OM image of a lateral crack, (c) SE image of a pile-up and (d) dislocations in an overlay of a CL and SE image at an indentation.